

CLAIMS

1. Optical wavelength filtering device comprising at least one input optical fibre and at least one output optical fibre, characterised in that it comprises:

- 5 - means of transferring at least one spectral band of at least one signal with multiple wavelengths incident through at least one of the said input optical fibres, to at least one of the said output optical fibres;
 the said means of transferring using at least one
 10 diffractive programmable element located in an intermediate plane between the said input optical fibre(s) and the said output optical fibre(s),
- and programming means to configure the said programmable diffractive element so that it has a
 15 spatial period P in the said at least one direction, such that a spectral band centred on a given wavelength λ_i is diffracted in the said at least one direction by the said programmable diffractive element at a predetermined angle θ_i
 20 such that $\sin\theta_i = \frac{k\lambda_i}{P}$, where k is an integer number,
 the said programming means introducing a disturbance to the said spatial period P equivalent to a variation less than the size of a pixel of the said programmable diffractive
 25 element.

2. Device according to claim 1, characterised in that the said programming means are used to configure the said programmable diffractive element such that it has a spatial period P comprising:

- 5 - at least one sub-period comprising N_1 pixels;
 - at least one sub-period comprising N_2 pixels;
 where N_1 and N_2 are two distinct integer numbers.

3. Device according to any one of claims 1 and 2, characterised in that it comprises a matrix with at least
10 two output optical fibres each forming a spectral filter.

4. Optical device according to claim 3, characterised in that the position of the said output optical fibres in space is predetermined as a function of the filtering to be done.

15 5. Optical device according to any one of claims 3 and 4, characterised in that the size of the core of the said output optical fibres is predetermined as a function of the filtering to be done.

20 6. Optical device according to any one of claims 3 to 5, characterised in that the said output optical fibres are located on at least one isochromatism circle.

7. Optical device according to any one of claims 1 to 6, characterised in that the said diffractive element is a programmable digital hologram.

25 8. Optical device according to claim 7, characterised in that the said programmable digital hologram is displayed on a spatial light modulator with amplitude or phase modulation levels, the said levels being continuous or quantified.

9. Optical device according to claim 8, characterised in that the said spatial light modulator is associated with at least one fixed diffractive element.

10. Optical device according to any one of claims 1
5 to 9, characterised in that it comprises a collimator lens,

and in that the said diffractive element acts in reflection and is located in the image focal plane of the said collimator lens,

10 and in that the said at least one input optical fibre and one output optical fibre are located in an object focal plane of the said collimator lens,

so as to form an optical set up in free space of the folded 4-f type.

15 11. Optical device according to any one of claims 1 to 7 and 9, characterised in that it comprises two collimator lenses, called the first and second lenses respectively,

20 in that the said diffractive element is located in the image focal plane of the said first lens and in the object focal plane of the said second lens,

in that the said at least one input optical fibre is located in the object focal plane of the said first lens,

25 and in that the said at least one output optical fibre is located in the image focal plane of the said second lens,

so as to form an optical set up in free space of the 4-f type.

12. Optical device according to any one of claims 3 to 11, characterised in that each of the said fibres in the said output optical fibres matrix is characterized by its position with respect to the optical axis of the said device, such that the said device forms a set of at least two tuneable filters,

and in that it comprises holographic means for adjustment of the spectral selectivity of each of the said filters, as a function of the said position with respect to the optical axis of the said corresponding output optical fibre.

13. Optical device according to any one of claims 1 to 12, characterised in that the said output optical fibres are single mode fibres.

14. Optical device according to claim 13, characterised in that at least one of the said single mode fibres has at least one lens at its end, so as to form a single mode fibre with lens.

15. Optical device according to claim 14, characterised in that the said lens comprises at least one fibre segment with an index gradient added on by assembly and fracture.

16. Optical device according to claim 15, characterised in that the said lens also comprises a silica fibre segment between the said single mode fibre and the said fibre segment with an index gradient added on by assembly and fracture.

17. Optical device according to any one of claims 1 to 16, characterised in that it comprises means of

adjusting a filter template applied to at least one of the said wavelengths.

18. Optical device according to claim 17, characterised in that the said filter template is
5 superposed to the said programmable diffractive element.

19. Optical device according to claim 17, characterised in that the said filter template forms part of the said programmable diffractive element.

20. Spectral band router characterised in that it
10 comprises at least one optical device according to any one of claims 1 to 19, the said device(s) comprising at least two output optical fibres.

21. Spectral band router according to claim 20, characterised in that the said diffractive element is
15 dynamically configured so as to route at least two distinct spectral bands of at least one incident signal, to corresponding distinct output optical fibres F_j .

22. Spectral band router according to claim 20, characterised in that the said programming means can be
20 used to configure the said programmable diffractive element, such that the said programmable diffractive element has a spatial period P in the said at least one direction, corresponding to the combination of a plurality of spatial periods P_i ,

25 in which each of the said spatial periods P_i is such that when the said programmable diffractive element has the said spatial period P_i , a spectral band centred on λ_i is transferred to the said output optical fibre F_j .

23. Chromatic dispersion compensation device characterised in that it comprises an optical device according to any one of claims 1 to 19.

24. Chromatic dispersion compensation device
5 according to claim 23, characterised in that at least one of the said output optical fibres is connected to at least one fibre segment with negative chromatic compensation.

25. Chromatic dispersion compensation device
10 according to claim 24, characterised in that the said fibre segments with negative chromatic compensation have a reflecting end.

26. Chromatic dispersion compensation device
according to any one of claims 23 to 25, characterised in
15 that the said output optical fibres are located on at least two distinct isochromatism circles.

27. Chromatic dispersion compensation device
according to either of claims 24 and 25, characterised in
that one end of the said optical fibre segment with
20 negative chromatic compensation is connected to a first output optical fibre, and that the second end is connected to a second output optical fibre.

28. Chromatic dispersion compensation device
according to claim 27, characterised in that the said
25 first and the said second output optical fibres are diametrically opposite on an isochromatism circle.